

## INFLUENCE OF CLASSROOM ENVIRONMENT ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS IN ABUJA

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### Abstract

This study examined the influence of classroom environment on senior secondary school (SS1) student's Mathematics Achievement in the Federal Capital Territory, Abuja. Quasi-experimental research design was used to test two hypotheses on the influence of two classroom variables, class size and instructional facilities on students' academic achievement in Mathematics. A sample size 150 students was selected from public secondary schools for the study using stratified and simple random sampling procedures. MAT instruments were used for data collection and a questionnaire. The reliability was established through Kuder – Richardson K-R-21 formula which gave the reliability index of 0.78. Mean and Standard deviation were used to answer the research question while Independent t- test was the inferential statistic adopted to test the hypotheses at 0.05 level of significant. The result of the analysis revealed that class size and availability of instructional facilities significantly influenced students' academic achievement in Mathematics among SS 1

students in Abuja. Based on these findings, the following recommendations were made among others; Government should increase funding on provision of conducive classroom environment with optimum class sizes. Instructional facilities for teaching Mathematics should be made available in public schools.

**Keywords:** Class size, instructional materials, Mathematics, achievement.

### Introduction

The pursuit of enhancing the quality of Mathematics education has become a prominent concern among educational stakeholders in Nigeria. Mathematics is recognized as the cornerstone of science and technology, and its significance lies in its perceived pivotal role in fostering social, economic, and technological progress. In Nigeria's educational policy, Mathematics holds a paramount position, being compulsory

for all primary and secondary school students and a mandatory prerequisite for entry into tertiary institutions (Federal Republic of Nigeria, 2014). Despite this emphasis, a substantial number of students exhibit aversion or fear towards Mathematics, undermining their academic performance (Karjanto, 2017). Despite concerted efforts, the persistently high failure rates in Mathematics among senior secondary school students in both internal and external examinations remain a major apprehension for education stakeholders. Notably, the Chief Examiner's reports for the West African Senior School Certificate Examination (WASSCE) from 2010 to 2016 highlighted the poor performance of students in Mathematics, with over 50% scoring below the credit level (WAEC, 2016). Several factors influencing students' performance in Mathematics have been studied, with recent research in Nigeria identifying issues such as an unsuitable learning environment, strained teacher-student relationships, insufficient qualified Mathematics teachers, and inadequate use of instructional materials (Nwoke and Ugwuegbulam, 2016; Olaniyan and Salman, 2015).

Various studies underscore the impact of students' attitudes and classroom environments on academic achievement. For instance, research on public secondary schools revealed

that students perceiving Mathematics as challenging were less motivated and more likely to perform below average (Karigi and Tumuti, 2015). Additionally, investigations into university students' perceptions emphasized that the learning environment significantly influences outcomes, surpassing achievements at the school level (Meremikwu and Ibok, 2020). A survey in Cross River State further demonstrated the predictive power of classroom environment variables on students' Mathematics achievement (Meremikwu and Ibok, 2020).

Class size and the availability of instructional materials are identified as modifiable factors affecting the classroom environment. A poorly managed classroom, characterized by overcrowding, inadequate facilities, improper seating arrangements, and a lack of instructional materials, hampers effective teaching and learning. This inadequacy is prevalent in many Nigerian public schools and contributes significantly to the reported high failure rates in Mathematics (WAEC, 2016). Literature reviews consistently highlight the adverse influence of large class sizes on learning outcomes, as evidenced by studies in Nigeria (Shamaki, 2015; Adimonyemma, 2018; Ayeni and Olowe, 2016).

The importance of appropriate instructional material use for enhanced learning is widely

acknowledged. However, the intricate nature of Mathematics and science subjects necessitates ongoing research in this area. Seeking intervention options to improve learning outcomes, this study investigates the impact of classroom environment on senior secondary school students' learning outcomes in Mathematics in Abuja, Nigeria. Previous studies have shown that factors like instructional materials, school facilities, and class size significantly affect students' academic performance (Abdi, 2017). The current research aims to contribute insights into the influence of classroom environment on Mathematics learning outcomes in senior secondary schools in Abuja.

### **Statement of the Problem**

It is important to highlight the proactive efforts made by various stakeholders in the past to improve the teaching and learning of Mathematics. For instance, Nwoke and Ugwuegbulam (2018) identified several factors contributing to poor students' performance in Mathematics, including inadequately equipped schools, large class sizes, a curriculum that lacks relevance to students' daily lives, a shortage of qualified teachers, and insufficient teacher education programs. Similarly, a report on Developing Science and Mathematics Education (DSME) in Sub-Saharan Africa recommended a shift in teachers' roles from

mere presenters of knowledge to incorporating drill exercises, student-centered activities, and participatory teaching and learning methods. This aligns with the National Policy on Education (NPE, 2014), which advocates for starting every lesson with a practical problem and using instructional materials to foster analytical thinking and the application of knowledge in real-life situations. Despite these efforts, student performance in internal and external examinations remains unsatisfactory, particularly in Mathematics at the secondary school level (WAEC, 2020).

The Federal Capital Territory (FCT) is not exempt from this trend, as evidenced by students' underwhelming performance in Mathematics. Data from the Federal Capital Development Authority (FCDA), Department of Education, on the yearly WASSCE analysis reports indicate percentages of students with credit in Mathematics from 2011 to 2020 as 9.2%, 21.4%, 32.2%, 17.7%, 30.2%, 49.4%, 61.8%, 52.11%, 39.8%, and 58.4%, respectively.

The Chief Examiner's reports from the West African Examination Council for 2015-2020 have underscored the alarming poor performance of senior secondary students in external examinations, particularly in geometry, construction, and trigonometry. The root cause, as identified by Okwuoza and Ale

(2021), lies in students' challenges with correctly interpreting questions. This persistent issue of poor performance in Mathematics prompted the investigation undertaken in this study. Despite the proven effectiveness of various instructional strategies, there has been no significant improvement in the subject. Therefore, the researchers aim to explore the influence of the classroom environment on the achievement of senior secondary school students in Mathematics in Abuja, Nigeria.

### **Purpose of the Study**

The study intended to assess the influence of two elements of classroom environment namely instructional materials and class size on the achievement of senior secondary school students in Mathematics.

### **Research Question**

1. What is the influence of classroom size on students' mean achievement score in Mathematics?
2. What is the influence of instructional materials on students' mean achievement score in Mathematics?

### **Research Hypotheses**

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the mean achievement scores of students taught Mathematics based on class size.

2. There is no significant difference in the mean achievement scores of student in Mathematics based on the use of instructional materials.

### **Methodology**

The research design employed in this study was a quasi-experimental approach known as the non-equivalent pretest, posttest, control group design. The research was carried out in Gwagwalada Area Council, Abuja, Nigeria, focusing on the senior secondary school students (SS1) enrolled in public secondary schools within the area. The overall population encompassed 1,500 students across 12 public senior secondary schools, with a sample size of 150 students selected through a proportional sampling technique, representing approximately 10% of the total student population. The sample included 77 males and 73 females from SS1.

The data collection instrument utilized was the Mathematics Achievement Test (MAT), comprising 40 pre-standardized items aligned with the Senior Secondary School Certificate Examination (SSCE). The MAT was administered to both large and small classes, consisting of 90 and 60 students, respectively. Upon collection, the test scripts were marked and recorded. The research questions were addressed using mean and standard deviation, while the independent t-test served as the

inferential statistic to examine the two hypotheses at a significance level of 0.05.

The treatment duration for both the experimental and control groups spanned approximately ten weeks, adhering to the school timetable and scheme of work. Mathematics was taught four to five times a week, with some days allotted double periods. The research assistants, who were the regular Mathematics teachers of the students,

underwent one week of training by the researchers. The lesson plan, prepared by the researcher, was implemented in both the experimental and control classes. Each treatment group received about four periods per week, with each period lasting approximately 40 minutes. The entire treatment spanned 10 weeks, equivalent to 160 days or 6,400 minutes.

## Results

**Research Question 1:** What is the influence of classroom size on students' mean achievement score in Mathematics?

**Table 1: Mean and Standard Deviation of Mathematics Achievement Test (MAT)**

Variables	Groups	Number	Mean	Std
Class Size	Small class size	60	33.14	3.21
	Large class size	90	11.34	2.80

Table 1 result revealed that students in small class size had a mean achievement score of 33.14 with a standard deviation of 3.21 while students in large class size had a mean achievement score of 11.34 with a standard

deviation of 2.80. With this result, the students in small class size achieved better than the students in large class size. This indicated that class size have influence on the achievement of Mathematics students.

**Research Question 2:** Influence of instructional material on students' mean achievement score in Mathematics?

**Table 2: Pre-test and Post-test scores on influence of instructional facilities on students' achievement in Mathematics.**

Groups	Number of Students	Pre-test		Post-test		Gain Score
		Mean	SD	Mean	SD	
Experimental	60	33.14	12.62	75.78	10.34	42.64
Control	90	42.56	11.13	55.72	13.15	

From table 2, the mean achievement scores of students in the experimental and control group at their pre-test are 33.14 and 42.56 respectively. After the treatment, the post-test Mean achievement score for both the experimental and control group are 75.78 and 55.72 respectively. This indicated that students taught Mathematics with instructional materials showed achievement gain score of 42.64

The results of the analysis are presented as follows:

**Hypothesis 1.**

There is no significant difference in the Mean achievement scores of students taught Mathematics based on class size.

**Table 3. Independent T-Test Analysis of Class Size on Students' Academic Achievement in Mathematics**

Variable	N	Mean	SD	t – value	p-value
Small	60	18.23	5.64	4.47	0.000
Large	90	12.42	6.85		

Table 3 shows that the mean achievement score of small class and large class size is 18.23 and 12.42 respectively. The corresponding values of standard deviations are 5.64 and 6.85. The table reveals the t- value of 4.47 and p- value of 0.000. Since the p-value (0.000) is less than the confidence level of 0.05, then the null hypothesis stands rejected. Hence there is a significant difference in the Mean achievement of students' in Mathematics in small and large class size.

**Hypothesis 2.** There is no significant difference in the mean achievement scores of student in Mathematics based on the use of instructional materials.

**Table 4. Independent T-Test Analysis on the Use of Instructional Materials on Students' Academic Achievement in Mathematics**

Variable	N	Mean	SD	t-value	p-value
Experimental	77	16.76	6.85	5.73	0.001
Control group	73	7.28	11.52		

Table 4 shows that the mean achievement on those taught mathematics using instructional materials (experimental group) is 16.76 and those in control group has a mean score of 7.28, with corresponding values of standard deviation as 6.85 and 11.52 respectively. This shows t- value of 5.73 and p- value of 0.001. Since the p-value of 0.001 is less than the confidence level of 0.05 then, the null hypothesis stands rejected. Hence there is a significant difference in the mean achievement scores of students in Mathematics based on the use of instructional materials.

### Discussion

The study's findings indicate that students in small class sizes achieved higher mean scores in Mathematics compared to those in large class sizes, suggesting that being in a small class size positively influences students' overall achievement in the subject. This aligns with previous research by Nwoke and Ugwuegbulam (2016), which highlighted that a poor learning environment can impede learning and teaching outcomes. Factors such as non-conducive learning environments, poor teacher-student relationships, a lack of qualified Mathematics teachers, and inadequate use of instructional materials were identified as contributors to poor academic achievement in Mathematics.

Abdi (2017) also emphasized the influence of instructional materials and school facilities on students' performance in public secondary schools in Somalia, consistent with the observations of Olaniyan and Salman (2015) regarding the association between shortage of well-trained Mathematics teachers, inadequate teaching facilities, and poor student achievement. The study underscores the positive impact of instructional materials on students' academic achievement in Mathematics.

Furthermore, the results highlight a significant correlation between class size and academic achievement, with smaller class sizes associated with better performance. This finding is in line with the research by Meremikwu and Ibok (2020), which emphasized the positive influence of small class sizes on Mathematics achievement among senior secondary students in Akamkpa Local Government Area of Cross River State. Similar results were reported in a comparative study in Northern Nigeria, where students in an ideal learning environment outperformed those in less optimal conditions.

The study's second hypothesis reveals a noteworthy connection between teaching with adequate instructional facilities and higher students' performance in Mathematics achievement tests. These findings align with the conclusions drawn by Ayeni and Olowe (2016) and Olaniyan and Salman (2015), both of whom reported that the sufficiency of instructional facilities significantly influenced students' performance in mathematics.

Additionally, Abdi (2017) found that non-availability and non-use of instructional

materials in schools were independently associated with poorer performance in mathematics achievement tests. Similarly, Okwuoza and Ale's (2021) results suggest that students exposed to Math's kit instructional approach performed better in Mathematics compared to those exposed to conventional teaching methods. This underscores the effectiveness of instructional materials in enhancing the learning experience and outcomes in mathematics education.

### **Conclusion**

This study has shown that small class size and use of instructional materials positively enhances mathematics achievement of senior secondary school students. The reason for this is that when a classroom size and environment is conducive, the students are comfortable and likely to get more information compared to those who are in an un-conducive environment. When a classroom is well spaced and furnished with physical facilities coupled with attractive, social and psychological climate, learners become more focused and learning is meaningful. Good ventilation in the classroom is fundamental to the academic performance of students in school. Suleman,

(2014) was of the view that classroom buildings should be such that it should absorb and transmit sound view.

### **Recommendation**

Based on the findings, that small class size and the use of instructional materials positively influence mathematics achievement of senior secondary school students, therefore government should endeavour to put in place standard measures to control the classroom population and also provide adequate instructional materials for Nigeria schools. Secondly, the school administrators should ensure good maintenance culture and use of government provisions.

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